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Associations between structural quality aspects and process quality in Dutch early childhood education and care settings

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ABSTRACT

The relationship between structural quality and process quality in early childhood education and care (ECEC) has been addressed in several studies. However, the findings are not conclusive. The present study was conducted in the Netherlands, which has a strongly regulated mid-quality ECEC system regarding structural aspects, with still considerable variation in process quality. The study employed a multi-method approach and extended the existing research in two ways. First, both observations of teacher–child interactions as well as teacher-reported developmental and educational activities were included as indicators of comprehensive emotional and educational process quality constructs. Second, to examine the relation between process quality and structural quality, commonly studied structural quality characteristics were complemented by less frequently studied measures of the professional development activities and education programs implemented at the centers. Results indicate that group size and child-to-teacher ratio are not related to emotional and educational process quality in the Dutch ECEC system. Teachers' formal pre-service education has a positive, but small association with emotional process quality. The use of an education program and professional development activities at the center show the strongest associations with emotional and educational process quality. Implications for policy and practice are discussed.

Numerous studies have shown beneficial effects of high-quality, center-based early childhood education and care (ECEC) on children's social–emotional and cognitive development (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Curby et al., 2009; Howes et al., 2008; Mashburn et al., 2008; NICHD ECCRN & Duncan, 2003). ECEC quality is commonly defined by the structural and process characteristics that are thought to nurture child development (Howes et al., 2008; Layzer & Goodson, 2006; Sylva et al., 2006; Thomason & La Paro, 2009). Process quality refers to the child's day-to-day experiences in ECEC settings and encompasses the social, emotional, physical, and instructional aspects of children's activities and interactions with teachers, peers, and materials, that are seen as the proximal determinants of child development (Howes et al., 2008; Pianta et al., 2005; Thomason & La Paro, 2009). Structural characteristics of ECEC, such as group size, children-to-teacher ratio, and teachers' qualifications (Howes et al., 2008; Thomason & La Paro, 2009) are the distal and regulable aspects of ECEC, and are regarded as important preconditions of proximal process quality (Cryer, Tietze, Burchinal, Leal, & Palacios, 1999; Philips, Mekos, Scarr, McCartney, & Abbott-Shim, 2000; Phillipsen, Burchinal, Howes, & Cryer, 1997; Pianta et al., 2005; Vandell, 2004). Structural quality is the main objective of statutory quality regulations and national curricula (Bennet, 2005; Phillipsen et al., 1997), and a major factor in the macroeconomic costs of ECEC, whereas the potential benefits for individuals and society are primarily dependent upon process quality (Vandell et al., 2010). A positive relationship between structural and process quality, therefore, is essential for the costs-efficiency of ECEC. In general, smaller classrooms, smaller child-to-teacher ratios and higher teachers' education levels are presupposed to lead to higher process quality, and, through process quality, to better child outcomes (NICHD ECCRN, 2002). However, the evidence for strong and consistent relationships between structural and process quality is far from conclusive, as will be reviewed below.

A possible explanation for the mixed findings concerns the effect of strong statutory regulations of structural quality at the state or country level that reduce the variance and, therefore, for statistical reasons, can lead to weak and inconsistent relationships with process quality (Love et al., 2003). Another possible

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explanation is that the set of structural quality characteristics commonly studied may not be sufficient to explain the variance in process quality. Most studies to date have focused on the so-called 'iron-triangle' of structural quality: children-to-teacher ratio, group size, and teacher formal pre-service education (Phillipsen et al., 1997). Recent studies have included other structural quality aspects as well, in particular in-service professional development (Howes, James, & Ritchie, 2003; Zaslow et al., 2010) and the use of a program of planned developmental and educational activities for children, including guided play, collaborative work, and age appropriate emergent literacy, mathematics and science activities as indicators of process quality and predictors of child outcomes (Assel, Landry, Swank, & Gunnewig, 2007; De Haan, Elbers, Hoofs, & Leseman, 2013; Sylva et al., 2007). Especially in contexts with strong regulation of the iron-triangle structural quality characteristics, the remaining variation in process quality may be largely dependent on other, less frequently studied structural quality aspects.

The objective of the current paper is to contribute to the existing evidence by extending traditional structural quality measures with measures of continuous in-service professional development and the use of an education program to predict process quality of center-based ECEC. The study was conducted in the Netherlands, which has a strongly regulated ECEC system of average structural quality according to the comparative review by the Organisation of Economic Cooperation and Development of the statutory group sizes, child-to-teacher ratios and required teacher education level in 20 countries (OECD, 2006). Yet, despite strong national regulation and monitoring of structural quality, Dutch ECEC still shows considerable variation in process quality according to recent research (Helmerhorst, Riksen-Walraven, Vermeer, Fukkink, & Tavecchio, 2014; Leseman & Slot, 2013).

Relations between structural and process quality

The relationships between child-to-teacher ratio, group size, and process quality have been addressed in several studies in different countries. Smaller child-to-teacher ratios and smaller group sizes have been found to be associated with higher quality teacher–child interactions, as evidenced by responsive, warm, and supportive caregiving (Burchinal, Cryer, Clifford, & Howes, 2002; NICHD ECCRN, 2000; Phillipsen et al., 1997), and higher overall process quality (Barros & Aguiar, 2010; Burchinal et al., 2002; Mashburn et al., 2008; Philips et al., 2000; Phillipsen et al., 1997; Thomason & La Paro, 2009). Yet, other studies have found only weak relations (Blau, 2000) or no relations at all between child-to-teacher ratio and process quality (Pessanha, Aguiar, & Bairrao, 2007; Pianta et al., 2005), and between group size and process quality (Barros & Aguiar, 2010; Blau, 2000; Pessanha et al., 2007; Phillipsen et al., 1997). A cross-country comparison by Cryer et al. (1999) revealed that a smaller child-to-teacher ratio was related to higher process quality in Germany and the United States of America (USA), but not in Portugal and Spain. In addition, a negative relation was found between group size and overall process quality for Spain, but, remarkably, a positive relation was found for Germany. Note that the average group size in Spain was much bigger and showed stronger variation than in Germany, which may explain the contradictory results.

Dutch studies have shown similar mixed results. More favorable child-to-teacher ratios in Dutch day care centers were related to higher quality teacher–child interactions (De Kruif et al., 2009; De Schipper, Riksen-Walraven, & Geurts, 2006) and more learning opportunities (De Kruif et al., 2009), although the effects were rather small. In a study investigating day care for zero- to four-year-olds by De Schipper et al. (2006), group size was experimentally manipulated. Process quality was higher in smaller groups with a children-to-teacher ratio of 3:1 than in larger groups with a ratio of 5:1. However, other Dutch studies, with a correlational design, failed to replicate these findings (Fukkink, Gever Deynoot-Schaub, Helmerhorst, Bollen, & Riksen-Walraven, 2013; Vermeer et al., 2008).

Several studies examined the relationship between teachers' formal pre-service education, specific (pre- or in-service) training in ECEC, and process quality. Higher levels of formal education have been found to be associated with higher overall classroom quality (Blau, 2000; Cryer et al., 1999; Phillipsen et al., 1997), and, more specifically, with warmer, more supportive teacher–child interactions (Cryer et al., 1999; NICHD ECCRN, 2000; Pianta et al., 2005; Thomason & La Paro, 2009). A comprehensive review by Tout, Zaslow, and Berry (2006) showed that pre-service formal teacher education is more strongly associated with process quality if education includes ECEC content. However, also with regard to the effects of teacher pre-service education on process quality, previous research findings are not consistent. In a large-scale multi-site and multi-state study in the USA, Early et al. (2006) found mixed effects of formal education on classroom quality in center-based day care and pre-kindergarten. Teachers holding a degree above the bachelor level showed higher classroom quality than teachers holding a degree below the bachelor level, but there were no differences between the bachelor and the below-bachelor degrees. Similarly, specific early childhood training was positively related to classroom quality when teachers had lower formal education, but made no difference at or above the bachelor level. In a comparative review of seven large scale USA studies, moreover, Early et al. (2007) found contradictory effects of formal teacher education on process quality with effects varying from positive, null to negative. In a study by Leach et al. (2008) on daycare settings in the United Kingdom for infants and toddlers, no clear associations were found between the teachers' qualifications and experience, on the one hand, and observed process quality. Likewise, recent Dutch studies on day care for zero- to four-year-olds did not find effects of teacher education on process quality (De Kruif et al., 2009; Fukkink et al., 2013; Vermeer et al., 2008).

Increasing evidence indicates that in addition to formal pre-service education, in-service training, training- and coaching-on-the-job, and other strategies of continuous professional development with a focus on working with young children in ECEC settings contribute to process quality (Zaslow et al., 2010). For example, in a multi-state study in the USA, specialized training in ECEC with a focus on specific knowledge about child development was found to predict classroom process quality over and above formal education of the teacher (Philips et al., 2000). A meta-analysis by Fukkink and Lont (2007) revealed medium-sized average effects on caregivers' interaction competence of specialized training focusing on teacher–child interactions. Burchinal et al. (2002) studied the effects of additional training on the job on quality of care and found that teachers who had attended workshops for professional development were more sensitive in their interactions with children and provided higher overall quality of care compared to teachers who had not followed additional training. Several intervention studies have confirmed the benefits of in-service training (Hamre et al., 2012; LoCasale-Crouch et al., 2011) as well as of other professional development activities such as consultation, mentoring and coaching on the job (Campbell & Milbourne, 2005; Domitrovich et al., 2009; Howes et al., 2003; Pianta, Mashburn, Downer, Hamre, & Justice, 2008).

A relatively understudied aspect of quality in ECEC for zero- to four-year-old children is the provision of activities and materials that give particular content to children's experiences, often referred to as 'curriculum'. The relevance of these aspects was demonstrated in recent European studies involving preschoolers

that incorporated the regular and systematic provision over a longer period of time of developmental and educational activities, such as guided play, and teacher-managed language, literacy and math activities, into the process quality construct (De Haan et al., 2013; Kuger & Kluczniok, 2008; Sylva et al., 2006). These studies revealed that higher process quality thus defined was associated with children's progress in pre-academic skills (De Haan et al., 2013; Sylva et al., 2006). Note that the activities that are actually provided can be considered aspects of process quality because they directly influence children's day-to-day experiences, whereas the plan or *education program* that more or less successfully regulates the actual provision of these activities can be considered an aspect of structural quality. Several intervention studies, involving children from three to five years of age, have shown that the use of educational programs to promote pre-academic skills by providing age-appropriate language, literacy and numeracy activities can be effective as far as the targeted skills are concerned (Clements & Sarama, 2007; Dickinson & Caswell, 2007; Domitrovich et al., 2009; Fantuzzo, Gadsden, & McDermott, 2011; Lonigan, Farver, Philips, & Clancy-Menchetti, 2011). Also, interventions focusing on social–emotional competences are found to be effective in the targeted social–emotional domain (Domitrovich, Cortes, & Greenberg, 2007). Comprehensive education programs, such as, for example, High/Scope and recently Tools of the Mind, Creative Curriculum addressing a broad range of developmental and educational goals and providing an education program to ensure implementation of activities that serve these goals, have also been found to be effective for broad developmental outcomes (Barnett et al., 2008; Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Diamond, Barnett, Thomas, & Munro, 2007; Fantuzzo et al., 2011; Lambert, O'Donnell, & Abbott-Shim, 2008; Schweinhart & Weikart, 1997).

To summarize, children's actual activities and the balance between developmental and pre-academic educational content present in these activities can be considered an important aspect of process quality. The way in which the provision of these activities is regulated by the use of an explicit education program can be considered an important aspect of structural quality.

Measuring process quality

Process quality refers to the daily experiences of children in ECEC settings while engaging in activities and social interactions that drive development. Previous studies have mostly used systematic observation of the activities and interactions children engage in to assess process quality. However, despite the intuitive appeal of observation methods to assess process quality, there are also some limitations calling for the use of other assessment methods as well to supplement observations. Whereas observation measures of process quality are particularly suited to assess interaction quality and children's engagement in activities in real-time, they are less suited to assess how often and how consistently particular developmental and educational activities are provided over a longer stretch of time. In view of this, several studies have used teacher self-reports to assess process quality (Charlesworth et al., 1993; Walston & West, 2004; Xue & Meisels, 2004), occasionally in combination with observation measures, revealing small-to-moderate correlations between both methods (Kuger & Kluczniok, 2008). Self-reports can suffer from response bias due to social desirability, but yield more stable results over time than global observations of classroom quality (Pianta & Hamre, 2009). Combining different measures to assess process quality thus can increase the comprehensiveness of the quality assessment and strengthen the reliability and stability of the measurements by reducing method-bound error variance (Douglas, 2009).

Current study

The aims of the current study are twofold. First, classroom process quality of a representative sample of the Dutch ECEC system will be determined using the CLASS Toddler and teachers' self-reported activities. Second, the relationships between structural and process quality will be examined, including as structural characteristics teachers' education level, group size, children-to-teacher ratio, the implementation at the center of strategies of professional development, and the use of an education program. Based on prior research, particularly Dutch research, we expected only weak effects of teacher's education level, group size, and children-to-teacher ratio. In line with recent studies, we expected stronger effects of both the use of an education program and the provision of activities for continuous professional development. The present study contributes to the existing literature by extending traditional structural quality measures with measures of continuous in-service professional development and the use of an education program to examine the relation between structural and process quality of center-based ECEC.

The Dutch ECEC system consists of two main types of provision. The first type is center-based day care for children from birth until four years of age, on average attended for two full days a week (NCKO, 2011). The second type concerns preschools for two- to four-year old children, which are attended for two to four half days a week. At age four, almost all children in the Netherlands enter full-day primary school. The Dutch ECEC system is strongly regulated. The Dutch Childcare Act of 2005 prescribes a child-teacher ratio of 7:1 for two- and three-year-old children and a maximum group size of 12 for two- to three-year-old and 16 for three- to four-year-old children (Convenant Kwaliteit Kinderopvang, 2008). Also, teachers are required to have completed a minimum of three years vocational training in a relevant subject. The OKE (Promoting Development through Quality and Education) Act of 2010 brings day care centers and preschools under the same statutory quality framework and emphasizes the equal importance of social, emotional and cognitive outcomes for children. Although the two types of ECEC differ in the age range and socioeconomic background of the children served and stem from different traditions in ECEC (with a care and education orientation, respectively), differences in structural quality have largely disappeared due to successive new legislation. Differences in quality between the two types of provision are not the main focus of the current study, but will be controlled for in the main analysis.

Method

Participants

The present study used data from the ongoing national cohort study pre-COOL, which investigates the effectiveness of preschool education and care provisions in the Netherlands (Pre-COOL Consortium, 2012; pre-cool.nl). Pre-COOL was commissioned by the Dutch Ministry of Education, Culture and Sciences and the National Science Foundation. The cohort started in 2010, when children were two years old. At age five, children enter the national cohort study COOL on students' careers in primary and secondary education, and they will be followed-up until age eighteen. To increase the likelihood of pre-COOL children entering primary schools that take part in COOL, the sample was recruited in the following way. First, a random sample of 300 primary schools was drawn from the COOL cohort, of which, 139 (46.3%) agreed to participate. Next, the participating primary schools were asked to identify the preschools and day care centers that were attended by most of their new students. Municipal records and the internet were

Table 1
Descriptive statistics for classroom and teacher characteristics reflecting the aggregated classroom level information.

	Day care				Preschool			
	N	*M*	SD	Range	*N*	*M*	SD	Range
Children-to-teacher ratio	119	5.5	1.2	3–8	175	7.1	2.6	3–16
Group size	121	13.7	1.5	8–17	177	14.5	1.9	7–17
Professional development activities	119	2.95	.9	1.50–5.90	178	3.32	1.01	1.22–6.33
Frequency (*F*)/ percent (*P*)	*N*	%			*N*	%		
Educational program	74	64.9			166	97.1		
Classroom > 30% non-Dutch	36	23.5			110	55.0		
Age composition classrooms*								
0 years	59	48.0						
1 year	73	59.3						
2 years	120	97.6			176	98.9		
3 years	81	65.9			82	46.1		
Educational level								
Lower prepatory track	17	14.3			18	10.9		
4 years secondary vocational	49	41.2			67	40.6		
1–2 years intermediate vocational	11	9.2			9	5.5		
3–4 years intermediate vocational	19	16			31	18.8		
5 years secondary	16	13.4			28	17.0		
6 years secondary**	3	2.5			5	3.0		
Higher vocational	2	1.7			3	1.8		
University	2	1.7			4	2.2		
Teacher ethnicity								
Native Dutch	153	90.0			203	85.3		
Immigrant	17	10.0			35	14.7		

* Percentages reflect the number of classrooms, which included children of a given age as a percentage of the total number of classrooms for which this information was available. As most groups included children of different ages, the sum across percentages adds up to far over 100.
** Entry level university.

used to identify additional preschools and day care centers in the neighborhood of the schools. About 500 centers were approached, of which 263 agreed to participate in pre-COOL (52.6%). Within this sample, a total of 375 teachers of 182 centers (69.2%) participated in the current study by filling out the teacher questionnaire, providing information on 295 classrooms (170 preschool, 125 day care). Almost all teachers were women (99.2%) and predominantly Caucasian (89.4%). For logistic and methodological reasons, observations were only conducted in classrooms with at least four children participating in the child assessments of pre-COOL (not the topic of the present study), resulting in 162 centers (61.6% of the entire pre-COOL sample) with a total of 276 classrooms (155 preschool and 121 day care classrooms). The participating preschools and day care centers were geographically spread over all parts of the Netherlands, were located in urban, semi-urban and rural areas, and did not differ significantly on these characteristics from non-participating preschools and day care centers (Pre-COOL Consortium, 2012). The present study focused on provisions for two- and three-year-old children. The vast majority of classrooms included two-year-old children (96.9% for day care centers and 97.7% for preschools respectively) and three-year-old children (63% for day care centers and 43% for preschools respectively). Note that these percentages add up to more than 100%, because the classrooms are usually mixed-age groups, and the percentages reflect the number of classrooms with children of a given age. Classroom composition with regard to children's age and ethnicity differed between day care centers and preschools, as is representative for the Netherlands. Descriptive statistics of the final sample of 276 classrooms and 375 teachers are presented in Table 1.

Measures and procedures

The current study combined two approaches to assess process quality of Dutch center-based ECEC in a comprehensive way. The Classroom Assessment Scoring System Toddler (CLASS; La Paro, Hamre, & Pianta, 2011) was used to evaluate process quality by means of observations. The CLASS framework reflects the social–emotional and educational features of teacher–child and child–child interactions that have been found to be positively related to children's development of self-regulation, pre-academic, and social skills (Curby et al., 2009; Howes et al., 2008; Mashburn et al., 2008; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). In addition, a teacher self-report questionnaire was used to obtain information about the type of activities provided by the teachers on a larger time scale, focusing on the balance between affective behavior, play, pre-academic activities, and activities promoting self-regulation. Following the structure of the CLASS (La Paro et al., 2011), two comprehensive process quality constructs, Emotional Quality and Educational Quality, were defined using both observational measures and teacher reports as indicators. Emotional Quality included the CLASS dimensions Positive climate, Negative climate, Teacher sensitivity, Regard for child perspectives and Behavior guidance, and in addition the teacher-reported occurrence of emotionally supportive activities, support and enrichment of children's free play, and activities intended to promote self-regulation. In Dutch ECEC, children's free play is usually a situation in which children have a lot of freedom to choose what to do and how to do it, and considered especially important for social–emotional development (e.g., to acquire autonomy and social skills, but also to merely relax and enjoy). Hence, teacher's play support was included in the overarching Emotional Quality construct. Teacher-reported activities to promote children's behavioral self-regulation are conceptually related to the CLASS dimension, Behavior guidance, and were, therefore, also included in the Emotional Quality construct. The construct, Educational Quality, included the CLASS dimensions Facilitation of learning and development, Quality of feedback, and Language modeling, and teacher-reported measures reflecting the provision of language, literacy, math, and pretend play activities. Pretend play in the current study, in contrast to support of children's free play, represented teachers' deliberate guidance of children's symbolic play by modeling and scaffolding symbolization to enhance cognitive development. Pretend play, thus defined, has been shown to be related to gains in children's executive functions and language development (Barnett et al., 2008; Diamond et al., 2007). Therefore, pretend play was considered part of Educational Quality.

Observed process quality

An officially approved Dutch translation of the CLASS manual was developed for the present study. All observers were trained by a licensed CLASS trainer and achieved at least 80% agreement within one scale-point deviation with the trainer on an online test before they were admitted to the study (average agreement was 86.4%; agreement by chance was 33%), as recommended by the developers of the CLASS. Following the online test, the trainer conducted live observations with all observers once, prior to data collection. Inter-observer agreement of the live observations within one scale-point deviation was 89.9%. Each classroom was observed during one morning and all classrooms were observed within a three-month period in the Spring of 2011. Following instructions of the CLASS manual, observers rated classroom processes and teacher behavior during four 20 min cycles on the observation morning, resulting in a total of 1092 observation units. Observers were instructed to observe all regular activities as they occurred, except outdoor play, in line with the CLASS manual, while focusing on classroom interactions that included two- and three year olds in the classroom (the children of interest for the pre-COOL study). For each observation unit, also the main type of activity at stake was registered.

Classroom quality was rated on eight dimensions in two broad domains, using 7-point scales ranging from 1 or 2 (*classroom is low on that aspect*); 3, 4 or 5 (*classroom is in the midrange*); and 6 or 7 (*classroom is high on that aspect*). Descriptive statistics of the scores on the CLASS dimensions are displayed in Table 2.

Regarding the domain Emotional Quality, the observed processes were evaluated on five dimensions: *Positive climate* reflects the warmth, respect, and enjoyment displayed during interactions of the teacher and children; *Negative climate* reflects the overall negativity expressed in the classroom by the teacher and the children (scores are reversed); *Teacher sensitivity* is the extent to which the teacher is aware and responsive to the children's needs; *Regard for child perspectives* captures the degree to which the teacher's interactions with children and classroom activities capture the children's interests, and the degree to which children's independence is encouraged; *Behavior guidance* refers to the teacher's ability to promote positive behavior and redirect problem behavior.

Regarding the domain, Educational Quality, observed processes were evaluated on three dimensions: *Facilitation of learning and development* considers how well the teacher facilitates activities to support children's learning and development; *Quality of feedback* assesses the degree to which the teacher's feedback promotes learning and expands children's participation; *Language modeling* refers to the extent to which the teacher models and encourages children's use of language.

Observed type of activity

Observers registered the type of activity during each observation cycle. If several different activities were observed during a cycle, all activities were listed. In total, 15 different types of activity were observed across cycles, which were independently recoded by the first and second author into four main categories based on consensus: indoor free play, educational activities, such as circle time and book reading, creative activities, such as drawing, painting and crafts, and care routines, such as snack- and mealtimes, toileting and clearing up. When an observation cycle covered more than one of these main activity types, priority was given to the educational activity over the other activities, to creative activity over play and care routines, and to play over care routines, respectively, in order to obtain unambiguous codes for each cycle. For the main analysis, dummy variables were created to represent each observed type of activity (scored 1) versus all other activities (scored 0): *Free Play*, *Educational Activity*, *Creative Activity*, and *Care Activity*. About 9% of all observation cycles could not be unequivocally categorized and were combined with the reference category to avoid loss of data. These activities concerned, for example, celebrating a child's birthday, dish washing or another incidental activity.

The observed activity types represent scheduled time-slots and reflect the common day schedule of Dutch ECEC provisions. Previous research has shown differences between activity types in observed interaction quality (Cabell, DeCoster, LoCasale-Crouch, Hamre, & Pianta, 2013; Pianta et al., 2005) and children's developmental gains (Chien et al., 2010). Care routines, for example, were found to be related to lower emotional and instructional quality (Pianta et al., 2005), whereas free play was found to be related to smaller gains in children's language, literacy, and mathematics outcomes, compared to instructional activities (Chien et al., 2010). These findings underscore the importance of including different activity slots, representative for the normal day schedule, when measuring classroom process quality, as these slots may set different conditions for process quality due to characteristics that are inherent to the types of activities during these slots (for example, more or less teacher involvement or more or less triggering of language use).

Table 2
Descriptives of the process quality measures.

	M	SD	Range	*N* Classrooms	*N* Cycles
CLASS dimension					
Positive climate	5.42	1.17	1.00–7.00	276	1084*
Negative climate (recoded)	5.84	.38	5.00–7.00	276	1084
Teacher sensitivity	5.34	1.08	2.00–7.00	276	1084
Regard for child perspectives	4.24	1.34	1.00–7.00	276	1084
Behavior guidance	5.01	1.12	2.00–7.00	276	1084
Facilitation of learning and development	3.73	1.35	1.00–7.00	276	1084
Quality of feedback	2.91	1.20	1.00–7.00	276	1084
Language modeling	3.22	1.29	1.00–7.00	276	1084
Self-report					
Play	3.24	.57	1.43–4.71	299	
Emotional support	6.11	.61	4.00–7.00	301	
Self-regulation	4.15	.85	1.64–6.91	302	
Pretend play	4.08	.96	1.25–7.00	299	
Language activities	5.23	1.02	2.25–7.00	298	
Literacy activities	4.92	.96	2.00–7.00	297	
Math activities	3.81	1.03	1.75–6.92	302	

* Number of observation cycles with the CLASS.

Self-reported developmental and educational activities

A structured questionnaire for teachers was used to assess the developmental and educational activities provided to the children, with a focus on two- and three-year-old children, on a regular basis during the year. The list of affective, play-supporting, self-regulation promoting and academic activities presented to the teachers was carefully developed, based on extant research into social–emotional (Domitrovich et al., 2007) and self-regulation development (Barnett et al., 2008; Bierman et al., 2008; Diamond et al., 2007; Domitrovich et al., 2007;), and emergent academic skills (Clements & Sarama, 2007; Dickinson & Caswell, 2007; Klibanoff, Levine, Huttenlocher, Vasilyeva, & Hedges, 2006; Leseman & Van Tuijl, 2006), and extensively tested in pilot research to ensure age-appropriateness of the listed activities. Eight scales were constructed covering a broad range of behaviors and activities. The scales Emotional support, Play, and Self-regulation are considered indicators of emotional process quality, while the scales Pretend play, Language activities, Literacy activities, and Math activities are considered indicators of educational process quality. Descriptive statistics are presented in Table 4.

Emotional support (8 items; $\alpha = .88$) reflects the degree to which the teacher provides emotional support and comfort to children and shows verbal and physical affection. An example of an item is: "I hug the children or give them a pat on the head". The scale ranges from 1 (*never*) to 7 (*always*).

Play (9 items; $\alpha = .85$) assesses the degree to which the teacher provides children with opportunities for free, self-managed play and occasionally enriches children's play, for instance by asking questions or providing materials for richer play. Examples of items are: "I let the children play without interfering", "I ask children questions that stimulate their play". The scale ranges from 1 (*not applicable*) to 5 (*strongly applicable*).

Self-regulation (12 items; $\alpha = .88$) assesses the extent to which the teacher uses play, care routines and other activities to enhance children's behavioral self-regulation, for instance talking about feelings and emotions, helping them resolve peer conflicts or playing games in which children have to take turns. An example of an item is: "When children have a conflict I let them express their own opinion so they better understand what the other thinks". The scale ranges from 1 (*never*) to 7 (*always*).

Pretend play (8 items; $\alpha = .91$) represents to what extent the teacher stimulates cognitive distancing, symbolizing and pretend in children by modeling behavior and encouraging children to participate in symbolic and pretend play. An example of an item is: "I show children how to use an object for something else then intended, for instance driving a wooden block *as if* it is a car". The scale ranges from 1 (*never*) to 7 (*always*).

Language activities (8 items; $\alpha = .89$) assesses the average frequency of activities involving several forms of language use, including singing, rhyming, conversations, and vocabulary instruction. An example of an item is "Having elaborate conversations about children's personal experiences, for instance what they did in the weekend". Answers were rated on a 7-point scale, ranging from 1 (*never*), 2 (*less than twice a month*), 3 (*twice or thrice a month*), 4 (*weekly*), 5 (*two to four times a week*), 6 (*daily*) and 7 (*three or more times a day*).

Literacy activities (4 items; $\alpha = .82$) measures the average frequency with which activities are provided involving literacy and literacy materials. An example of an item is: "Asking the children questions about the content of the story during or after reading the story". Answers were rated on the same scale as Language activities.

Math activities (12 items; $\alpha = .91$) assesses the average frequency of several math activities, for instance counting and sorting activities, and activities exploring different shapes. An example of an item is: "Counting how many objects you have, for example counting till five and saying 'I have five marbles'". Answers were rated on the same scale as the Language activities.

Structural classroom and center characteristics

Teachers filled out a questionnaire addressing group size, number of adults present in the classroom, and their own professional training and demographic background. In addition, teachers reported on the professional development activities provided by their center and the use of an education program. For the present purpose, the following structural quality variables were constructed; descriptive statistics are given in Table 1:

Group size was computed as the teachers' reported maximum number of children in the classroom during regular days of the week.

Children-to-teacher ratio was computed by dividing group size by the number of licensed professionals present during regular days, as reported by the teachers, not including student-teachers on an internship, household personnel, center managers or, occasionally, volunteering parents.

Teacher's education was defined as the highest level of completed formal pre-service education and was measured on a scale representing the levels of the Dutch secondary and tertiary education system, ranging from 1 (*lower preparatory vocational education*) to 8 (*university education*).

Education program reflects the use by teachers of a structured education program. In the Netherlands, several education programs, approved by the national Accreditation Committee for Child and Youth Interventions of the Netherlands' Youth Institute (www.nji.nl), are currently used in ECEC, in both day care centers and preschools. Although these programs differ in how teachers are trained and monitored, they all aim at broad developmental and educational goals, emphasize emotional support, sensitivity to children's needs, and provide a mixture of play and pre-academic activities with an emphasis on language and literacy. All programs use manuals listing activities that can be provided, work with themes (e.g., the seasons of the year, important feasts) and contain week-, month- and year-schedules for providing the themes and activities. Some programs also use specific materials as part of the program, such as picture and storybooks, experiential Montessori materials, or puppets to elicit talk during circle time. For the present purpose, a dummy variable was created, indicating whether an education program was used with the values 1 = *yes* and 0 = *no*, without further distinguishing between the programs.

Professional development (8 items; $\alpha = .91$) assesses the implementation of several strategies of continuous professional development at the center, within the team of teachers. A questionnaire listing several professional development activities was presented. Teachers rated how frequently these activities occurred, with a scale ranging from 1 (*never*), 2 (*less than once a month*), 3 (*once a month*), 4 (*twice or thrice a month*), 5 (*weekly*), 6 (*two to four times a week*), and 7 (*every day*). Examples of professional development activities included in the list were: having regular staff meetings to discuss the developmental and educational goals of working with young children, discussing children with special developmental and educational needs, using collegial observation and feedback to improve practice, opportunities for in-service training and personal coaching, team-based reading of professional literature, and visiting professional conferences.

Type of provision represents whether the classroom was part of a day care center or preschool. To control for possible confounding of type of provision with structural quality characteristics, a dummy variable was created and included in the main analysis, with the values 1 = *preschool* and 0 = *day care*.

Other measures

For the purpose of sample description, additional information was obtained about the age and ethnic composition of the classrooms, and about teachers' gender, age, work experience, and ethnic background. These measures were not included in the main analysis.

Analysis strategy

Following most studies into ECEC quality, the present study focused on the classroom and in addition, within the classroom, on the observed activity setting as the units of analysis. Quality was considered a multifaceted construct and assumed to be represented by a set of observed and teacher-reported variables covering both emotional and educational process quality in real-time as well as on a larger time scale. Observations were conducted in four distinct situations within each classroom, yielding a nested data structure. Although it is common in ECEC research to aggregate detailed observation measures to the classroom level, a clear disadvantage is the loss of potentially relevant information (Hox, 2010). In order to combine the multiple indicators in a single model of process quality and to take the nested data structure into account, Multilevel Structural Equation Modeling was applied using the Mplus statistical package (Version 7; Muthén & Muthén, 1998–2012).

Due to the design of the study and non-response, complete observational and self-report data were available for 162 classrooms (60% of all observed classrooms). Classrooms with and without teacher self-reports did not differ significantly on any of the CLASS dimensions. When two or more teachers reported on the same classroom, scores were aggregated to the classroom level (agreement between teachers of the same classroom was considered sufficient, with an average ICC of .563). Classrooms with and without observations differed significantly on three of fourteen self-reported measures. Classrooms with observations used an education program less often compared to classrooms without observations. Further, classrooms with observations had slightly lower scores on self-reported language and math activities than classrooms without (all standardized effect sizes <.28). There were no further missing data in the observation measures, and occasionally missing data on particular activities and structural classroom characteristics in the self-reports were below 8%. As recommended, missing data were dealt with by using full information maximum likelihood (FIML) estimation in Mplus (Enders, 2010), in which the standard errors for the parameter estimates are computed using the complete observed information matrix (Muthén & Muthén, 1998–2012).

The main analysis was carried out in four steps. First, the intraclass correlations (ICC's) were calculated separately for each CLASS dimension to determine the proportions of *within* and *between classrooms* variance. Second, the measurement model of process quality was estimated at the within and the between classrooms level using a non-restricted baseline model that included all observed and self-reported process quality indicators. Following the proposed structure of the CLASS (La Paro et al., 2011), a two-factor model was examined with the CLASS dimensions and teacher-report scales as indicators of two latent factors representing emotional and educational process quality, respectively, and was tested against a one-factor model. At the *within classrooms* level the latent quality factors were represented by the CLASS dimensions that were scored during the (mostly) four observation cycles in each classroom, leading to an estimate of the variance in observed quality across observation cycles within classrooms. At the between classrooms level the quality factors were represented by the classroom level variance component in the intercept of each CLASS dimension and by the teacher reported curriculum activities. Finally, all predictors at the within level (types of observed activity) and between level (all structural quality characteristics) were entered into the resulting measurement model to test the relationships between the predictors and the process quality constructs at the within and between classrooms level, respectively. Note that at the within classroom level, Care Activity was the reference category and, therefore, not included as predictor. The model was trimmed by eliminating non-significant paths with $p > 10$ and $|\beta| < .05$ in a step-by-step fashion to obtain the most parsimonious model (Wuensch, 2012). Model fit was evaluated with several fit indices: the ratio of the Chi-Square and the degrees of freedom (Chi-Square/df), the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR) at both the within and between classrooms level, with Chi-Square/df < 3, CFI > .90, RMSEA < .08, and SRMR < .08 indicating acceptable to good fit. The Chi-Square/df ratio was used as indicator of model fit rather than the Chi-Square test, because the latter is rather sensitive to small violations of the multi-normality assumption with large samples (Kline, 2005). Improvement of the model fit was evaluated by testing the significance of the change in Chi-Square relative to the change in degrees of freedom. Standardized regression coefficients were used as measures of the effect size with $\beta < .10$ indicating a small effect, a β of around .30 a medium-sized effect and $\beta > .50$ indicating a large effect (Kline, 2005).

Results

Descriptive statistics of the sample, the structural characteristics of the classrooms and centers, the process quality observation measures and the self-reported quality measures are presented in Tables 1 and 2. Regarding the process quality measures based on the CLASS observations at the cycle level, the results reveal moderate to high emotional process quality and low to moderate educational quality. The pattern of activities that was observed is in line with the highly regular day schedule that is typical of ECEC classrooms in the Netherlands with Free Play as a predominant type of scheduled activity, occurring in 26.6% of all observation cycles, and an Educational Activity, Care Activity and Creative Activity occurring in 25.7%, 24.3%, and 14.3% of the observation cycles, respectively (as reported above, in 9% of the cycles no clear activity type could be identified). There were slight differences between day care and preschool classrooms. In day care classrooms, more time was spent on care routines due to the care for younger children present in the groups. In preschools, more time was spent on educational activities reflecting the slightly older age of the children and the stronger educational orientation of this type of provision.

The teachers' self-reports show a comparatively high level of emotional support and much lower levels of educational support through providing pretend play and academic activities, with the reported support of children's self-managed play falling in-between.

Table 3 shows the bivariate correlations between all process quality indicators. The inter-correlations of the CLASS dimensions were moderate to strong. Also, the inter-correlations between the self-reported process quality indicators were moderate to strong. The correlations between the CLASS dimensions and the self-reported activities were mostly significant and generally in the expected direction, but much smaller in magnitude. Table 4 presents the intraclass correlations for all CLASS dimensions, revealing significant within and between classrooms variance, indicating that multilevel modeling is indeed required.

As the first step of the main analysis, the measurement model of process quality was examined at the within and the between classrooms level. Based on theoretical considerations, a two-factor multilevel model was estimated specifying a latent emotional support and a latent educational support factor, both with multiple

Table 3
Bivariate correlations between self-reported activities and observed CLASS dimensions aggregated at the classroom level.

			Teachers' self-reports								CLASS dimensions						
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Self reports	1	Pretend play		.61**	.57**	.33**	.40**	.36**	.42**	.11	.03	.03	.05	−.01	.32**	.20**	.24**
	2	Play			.53**	.37**	.46**	.34**	.36**	.20*	.06	.08	.07	.05	.25	.22**	.24**
	3	Self-regulation				.45**	.46**	.39**	.52**	.13	.11	.07	.09	.06	.25**	.13	.18*
	4	Emotional support					.24**	.27**	.21**	.15†	.10	−.03	−.01	.07	.12	.11	.13†
	5	Language						.67**	.61**	07	.27**	.02	−.09	.01	.23**	.3	.14†
	6	Literacy							.44**	.14†	.25**	.05	−.00	.06	.19*	.16*	.13
	7	Math								10	.16*	.05	−.12	.02	.24**	.08	.16*
CLASS	8	Positive climate									.32**	.61**	.43**	.48**	.55**	.53**	63**
	9	Negative climate										.34**	.21**	.42**	.25**	.28**	.24**
	10	Teacher sensitivity											.51**	.64**	.50**	.41**	.54**
	11	Regard for child perspectives												.44**	.52**	.47**	.50**
	12	Behavior guidance													.44**	.39**	.41**
	13	Facilitation of learning														.72**	.77**
	14	Quality of feedback															.74**
	15	Language modeling															

* $p < .05$
** $p < .01$.
† $p < .10$.

Table 4
Intraclass correlations (ICC) for the CLASS dimensions in the model.

Variable	ICC	Between-variance (SE)	Within-variance (SE)
Positive climate	.51*	.35 (.04)*	.61 (.08)*
Negative climate	.36*	.08 (.02)*	.20 (.07)*
Teacher sensitivity	.37*	.29 (.04)*	.61 (.08)*
Facilitation learning	.30*	.46 (.04)*	.73 (.08)*
Quality of feedback	.37*	.38 (.04)*	.58 (.08)*
Language modeling	.54*	.40 (.04)*	.58 (.07)*

$N_{within} = 1313$, $N_{between} = 398$.
* $p < .05$.

indicators. At the within classrooms level, these indicators are the CLASS dimensions as scored for (mostly) four observation cycles per classroom. At the between classrooms level these indicators are the classroom level intercept variances of the CLASS dimensions and the teachers' curriculum activities reports. The model showed poor model fit ($\chi^2(108) = 662.77$, $p = .00$; $\chi^2/df = 6.14$; RMSEA = .07; CFI = .82; $SRMR_{within} = .09$, $SRMR_{between} = .24$). As suggested by the modification indices (MI) provided by Mplus, we then allowed the error variances of the self-reported practices and the observation measures to correlate (indicating the presence of method-bound covariances not captured by the two process quality factors), which improved the model fit significantly ($\Delta\chi^2(14) = 334.72$, $p = .00$, with resulting model fit indices showing acceptable fit: $\chi^2(94) = 328.05$, $p = .00$; $\chi^2/df = 3.49$; RMSEA = .05; CFI = .92; $SRMR_{within} = .05$, $SRMR_{between} = .19$). Comparison with a one-factor model ($\chi^2(61) = 235.72$, $p = .00$) favored the two-factor solution ($\Delta\chi^2(33) = 92.33$, $p = .00$). Fig. 1 shows the final measurement model.

The analysis was conducted on the whole sample, pooling the two types of ECEC provision. To check whether this was

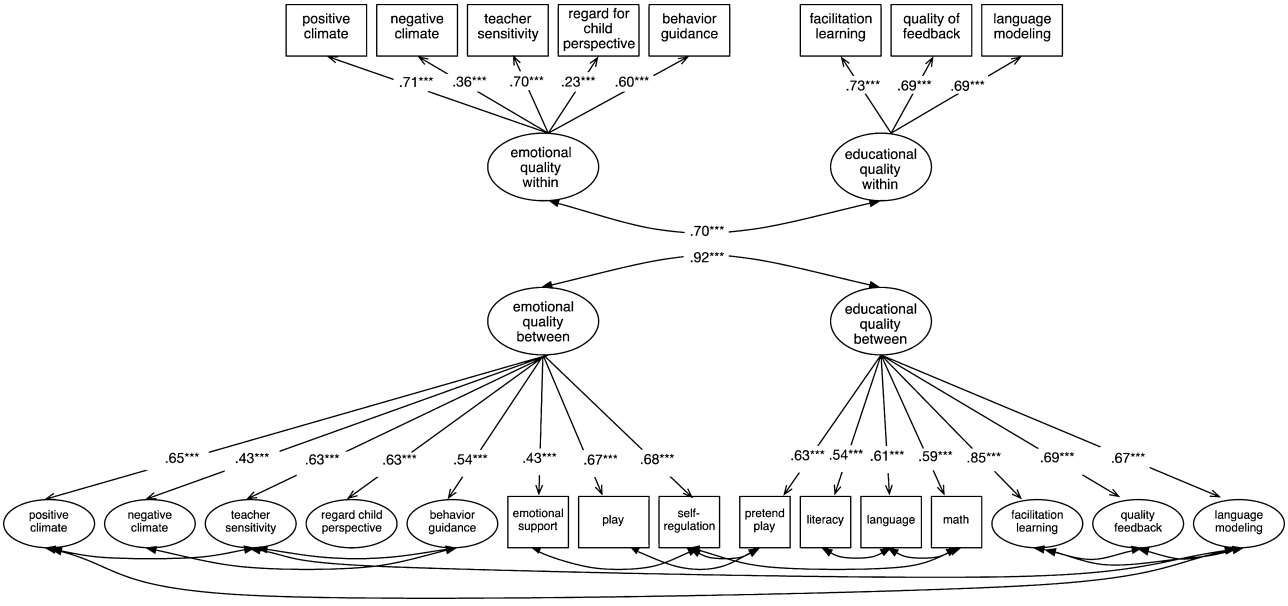

Fig. 1. *Final quality model with predictors of the within and between level quality constructs.* Note that the latent quality constructs at the within classrooms level are represented by the CLASS dimensions as scored during the (mostly) four observation cycles on an observation morning. The latent quality constructs at the between classrooms level are represented by the classroom level variance component in the intercept of each CLASS dimension and by the teacher reported curriculum activities. Characteristics of the observation cycles (type of activity at stake) are predictors of the latent factors at the within level. Characteristics of teacher and classroom are predictors of the latent factors at the between level.

Table 5
Within level and between level predictors of emotional and educational quality ($N = 276$ classrooms).

	Emotional quality			Educational quality		
	B	SE *B*	β	*B*	SE *B*	β
Predictor						
Within level						
Educational activity	.17	.05	.13**	.89	.09	.44***
Creative activity	.15	.06	.09*	.49	.09	.19***
Free play activity	−.08	.06	−.06	.31	.08	.15***
Between level						
Teacher education level	.05	.02	.21*	.03	.02	.10
Group size	−.03	.03	−.15	.00	.02	.01
Children-to-teacher ratio	−.00	.02	−.02	.01	.02	.08
Education program	.11	.10	.11	.23	.11	.22*
Professionalization	.17	.05	.40***	.21	.05	.50***
Type of provision	.08	.09	.10	.09	.10	.11

* $p < .05$.
** $p < .01$.
*** $p < .001$.

appropriate, a multi-group analysis was performed splitting the sample into two subsamples of day care and preschool groups, respectively, to examine measurement invariance across the two types of provision. The results indicated complete measurement invariance with acceptable fit of the multi-group model to the data ($\chi^2(220) = 535.301$, $p = .00$; $\chi^2/df = 2.43$; RMSEA = .05, CFI = .90; $SRMR_{within} = .06$, $SRMR_{between} = .21$).

Next, all predictors were added to the model: the observed type of activity at the within classrooms level and the structural quality characteristics at the between classrooms level. Model fit was not satisfactory ($\chi^2(190) = 956.06$, $p = .00$; $\chi^2/df = 5.03$; RMSEA = .06; CFI = .78; $SRMR_{within} = .08$, $SRMR_{between} = .15$). The modification indices revealed an estimation problem related to the dimension Regard for child perspectives (MI = 236.98). Upon closer examination of the data, Regard for child perspectives was found to be rated especially high for free play, but relatively low for the other activity types, whereas most other quality measures were found to be rated relatively low for free play and high for the other activity types, indicating misfit. Therefore, we decided to remove Regard for child perspectives from the model. We will return to this issue in the Discussion section. After removing this dimension, the model fit was acceptable $\chi^2(162) = 410.563$, $p = .00$; $\chi^2/df = 2.53$; RMSEA = .04, CFI = .92; $SRMR_{within} = .04$, $SRMR_{between} = .12$), however with several non-significant paths. To obtain a more parsimonious model, the covariances that were not significant at $p < .10$ and with $|\beta| < .05$ were constrained to zero, yielding a good model fit ($165) = 408.70$, $p = .00$; $\chi^2/df = 2.48$; RMSEA = .04, CFI = .92; $SRMR_{within} = .04$, $SRMR_{between} = .12$). At the *within classrooms* level, different types of activities were related to higher observed emotional and educational process quality compared to the reference category Care Activity (see Table 5). Providing creative and educational activities to children was associated with higher emotional process quality as observed with the CLASS, with small effect sizes according to Kline (2005). The provision of educational and creative activities as well as free play was associated with higher educational process quality, compared to quality in care routines, with the educational activities showing a medium-to-strong effect size according to Kline (2005). In addition, based on the raw means resulting from the CLASS observations, we compared the educational quality of educational activities to the educational quality of free play activities, showing that educational activities, on average, resulted in substantially higher educational quality than free play did (Cohen's $d = .52$, a medium-sized effect) (Cohen, 1992).

At the *between-classrooms* level, four predictors were significantly related to emotional and educational process quality (see Table 5). Teacher pre-service education positively predicted emotional process quality, but the effect size was small according to Kline (2005). Using an education program was related to higher educational process quality, with a small-to-medium effect size. The provision of professional development activities was the strongest predictor of emotional and educational process quality, with medium-to-large effect sizes. Group size and children-to-teacher ratio did not significantly explain variance in emotional nor educational process quality.

Discussion

The present study examined the relationship between structural and process quality in Dutch day care and preschool classrooms using a multi-method approach. Emotional and educational process quality were defined as comprehensive, multifaceted constructs, which included observed social–emotional and educational aspects of teacher–child interactions, as well as the developmental and educational activities teachers reported to provide to children, unlike most studies conducted until now that focused either on observed (NICHD ECCRN, 2000; Pianta et al., 2005) or self-reported quality (Charlesworth et al., 1993; Xue & Meisels, 2004). Furthermore, to predict emotional and educational process quality, the present study combined frequently studied structural quality characteristics, such as group size, children-to-teacher ratio and teacher pre-service education, with less frequently studied structural quality aspects, in particular the implementation of professional development activities and the use of an education program.

The results of the observations with the CLASS showed that process quality in Dutch ECEC was, on average, moderate to high regarding emotional and behavioral support, but low to moderate regarding educational support, which is in line with findings in other studies from the Netherlands as well as other countries (Helmerhorst et al., 2014; Pakarinen et al., 2010; Pianta & Hamre, 2009; Thomason & La Paro, 2009; Weiland, Ulvestad, Sachs, & Yoshikawa, 2013). From the teachers' self-reports, a similar overall pattern appeared. Teachers reported to frequently provide children with emotional supportive activities, such as comforting children and showing children verbal and physical affection, and to be moderately inclined to support children's self-managed play. However, teacher-guided pretend play and academically focused activities were provided less frequently. The present results are consistent with findings in previous Dutch research and in other European studies, in which the provision of activities was assessed with an observation method (Anders et al., 2012; De Kruif et al., 2009; Hall

et al., 2009) or with a combination of observations and teachers' self-reports (Kuger & Kluczniok, 2008).

As reviewed in the introduction section, previous evidence on the relationship between structural quality and process quality is not conclusive (Cryer et al., 1999; Early et al., 2007). The findings of this study add to this evidence. Group size and child-to-teacher ratio were not significantly related to emotional and educational process quality, contrary to findings in several studies in the USA (Burchinal et al., 2002; Mashburn et al., 2008; NICHD ECCRN, 2000; Philips et al., 2000; Thomason & La Paro, 2009), but, at least partly, in line with findings of previous Dutch studies (De Kruif et al., 2009; De Schipper et al., 2006; Vermeer et al., 2008) and other European studies (Barros & Aguiar, 2010; Pessanha et al., 2007). The absence of effects of group size and child-to-teacher ratio in the current study is likely due to the limited variation in these structural characteristics (Love et al., 2003). Teacher formal education level was positively related to emotional process quality, consistent with other studies (Blau, 2000; Cryer et al., 1999; NICHD ECCRN, 2000; Phillipsen et al., 1997; Pianta et al., 2005), but the size of the relationship was rather small. Previous Dutch studies did not find effects of teacher formal education level on process quality at all (De Kruif et al., 2009; Vermeer et al., 2008). Note that the variation in education level was restricted, as in previous Dutch research (De Kruif et al., 2009), which can explain the lack of stronger effects.

Three characteristics of Dutch ECEC were found to be associated with process quality. At the *within-classrooms* level, this included the provision of activities with an educational focus. At the *between-classrooms* level, this included two structural quality characteristics, namely the use of an education program and implementation of professional development activities at the team and center level.

First, at the within-classrooms level, emotional process quality as observed with the CLASS was highest during creative and educational activities in smaller subgroups, including circle time, book reading, arts and crafts, and making puzzles, compared to care routines, which is consistent with other research (De Schipper et al., 2006; Pianta et al., 2005). In addition, educational process quality was higher during creative and educational activities, and to a less extent during free play, compared to educational quality during care routines, with educational activities being most strongly associated with educational process quality. In particular, observed educational quality was significantly higher during educational activities compared to free play, with a medium-sized effect. Apparently, different types of activity set different conditions for emotional and educational process quality due to characteristics inherent to the types of activity. For example, free play in the Dutch case is overall marked by low teacher involvement, whereas educational and creative activities trigger more teacher-guided educational talk (De Haan et al., 2013). Although the distribution of activity types during the day is not a structural quality characteristic in the usual sense, it is part of the planned day schedule of ECEC provisions, which at least to some extent, is regulable.

This relates to the second major finding of the present study. At the between-classrooms level, the use of an approved high-quality comprehensive education program was found to be moderately related to educational process quality. The results of the present study are in line with evidence from intervention research in ECEC revealing positive effects of comprehensive programs on classroom quality and child outcomes (Barnett et al., 2008; Bierman et al., 2008; Fantuzzo et al., 2011; Lambert et al., 2008).

The third major finding was that providing professional development activities at the center is most strongly associated with emotional and educational process quality, which is consistent with findings in other studies in ECEC and with research on concepts of professional development such as reflective practice and team learning (Howes et al., 2003; Pianta et al., 2008; Zaslow et al., 2010).

Overall, the results of the current study only partially replicated findings from previous Dutch studies on ECEC quality (De Kruif et al., 2009; Vermeer et al., 2008). Most importantly, we did not find significant associations of group size and child-to-teacher ratio with process quality. A possible explanation is that the previous Dutch studies were conducted before the recent changes in the national ECEC policy. With new legislation in 2005 and 2010 concerning the maximum group size and child-to-teacher ratio, and the introduction of joint quality monitoring by the Municipal Health Authorities and the Inspectorate of Education, the range in structural quality may have become even more restricted.

There are several limitations to the present study. First, the study was conducted in the context of a strongly regulated ECEC system in the mid-range of structural quality (OECD, 2006). The conclusion that using an education program and providing professional development activities can raise process quality, therefore, can only be generalized to situations in which group size, child-to-teacher ratio and teacher education are within the boundaries of mid-range structural quality. Second, although the current sample of classrooms was recruited in relation to a random sample of primary schools, there was considerable non-response and missing data. The presence of selection effects cannot be ruled out, which limits the possibilities of generalizing the present findings. Note, however, that the sample was geographically well spread and that the overall findings concerning the average levels of both structural and process quality are largely in line with previous research in the Netherlands, suggesting the findings are representative for current Dutch ECEC. Third, the CLASS dimensions Regard for child perspectives did not fit well in the model after including the predictors. Differences in ECEC contexts between the Netherlands and the USA, in which the CLASS was developed and validated, may be at stake. For example, further inspection of the data showed that teachers' scores on the Regard for child perspectives were especially high during free play but not during other activities (on average one SD difference), whereas the scores on the other quality dimensions, such as teacher sensitivity and behavior guidance, were relatively low during free play compared to other activities. An explanation is that free play in the Dutch context is typically characterized by rather limited teacher involvement compared to other activity settings, allowing children much initiative but also providing them with little support and guidance (De Haan et al., 2013; Leseman, Rollenberg, & Rispens, 2001). A fourth limitation of the current study is that one of the predictors of process quality, the use of an education program, was correlated with type of ECEC provision. In the current sample, the majority of preschools but only just over half of the day care centers used an education program. However, possible confounding of type of provision (preschool or day care center) with the use of an education program was controlled by adding type of provision as a predictor to the model. In addition, multi-group analyses showed complete measurement invariance across the two types of provision, confirming that both types of provision can indeed be pooled. A fifth limitation concerns the correlational design of the current study, which limits the possibilities of drawing causal conclusions. For instance, an alternative explanation for the strong effect of continuous professional development might be that teachers who already provide higher quality also seek out more opportunities for further learning and development. Future studies using a longitudinal design can provide a stronger basis for conclusions about the direction of effects. Finally, the current study did not check the inter-observer reliability during data collection to monitor possible observer drift. Note, however, that, in addition to the standard CLASS training procedure, supervised live-observations were conducted with each observer prior to data collection and that the observations were completed within a three months period directly after the training.

To conclude, the current study adds to the existing evidence in several ways. First, we defined process quality as comprehensive construct that not only entails the emotional and educational quality of teacher–child interactions, but also the curriculum of activities provided to children, which present them with age-appropriate experiences and knowledge contents to develop knowledge and skills. Following this approach, we were able to model a comprehensive process quality construct based on different methods of data collection with different time scales (real-time observed interactions and on a larger time-scale reported curriculum activities), showing two broad domains of emotional and educational quality, respectively. Second, we included the use of education programs and continuous professional development as structural conditions of process quality, in addition to the widely studied 'iron triangle' structural characteristics for which inconsistent evidence has been reported. Our results revealed new potential starting points for improving process quality in strongly regulated ECEC systems in the mid-range of structural quality, like the Dutch system. Finally, we found an interesting culture-specific pattern regarding the way in which Dutch teachers seem to implement child-centeredness in ECEC, namely by providing children with ample opportunities for free play together with low teacher involvement. Child-centeredness, measured by the CLASS dimension Regard for child perspectives, was relatively high during free play (and low in other activity settings), but other quality measures implying sensitive teacher involvement and educational guidance were relatively low (and higher in other settings).

It is perhaps needless to emphasize that the present results need to be replicated and examined in other contexts and other ECEC systems. Moreover, it is important to examine whether the quality characteristics that were the topic of this study are indeed related to child wellbeing and child development in short and long term. If the present results are sustained, there may be important implications for policy and practice. For example, many countries are considering to raise the required education level of ECEC workers to the bachelor's level in order to enhance the quality, impact and economic benefits of ECEC (OECD, 2006). Whereas there may be several advantages of such a policy, it will raise the costs of ECEC considerably. Yet it may not be the most costs-effective way of improving process quality. Following the present results, it may be more efficient to concentrate on continuous professional development to enhance the quality of ECEC (Campbell & Milbourne, 2005; Domitrovich et al., 2009; Pianta et al., 2008). In addition, the use of an education program can enhance process quality by supporting teachers in providing children with appropriate developmental and educational activities.

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